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**PPD / EED / Infrastructure Group**

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**Calculated Voltage Drop Over Length of Power Cable Contained in NOvA Block Pivoter Cable Reel**

**Overview:**

As a moving device, the Block Pivot receives its power via a cable reel. The voltage drop of the length of cable is calculated and compared to the recommendations found in the National Electric Code (NEC).

**Cable Reel Information:**

Cable reel MC BNA361CN33-B617-RC-K04 was produced for the NOvA Ash River Building by Conductix-wamplfler. The manufacturer’s drawing indicates that it contains 393 feet of 4/0 3C Type G-GC cable.

Type G-GC cable not found in the NEC, but a web search suggests that it’s a portable power cable used for mining applications. I consistently found ratings of 2000V and 90°C.

**Voltage Drop Calculation:**

An accepted formula for the voltage drop for three-phase power over a cable of length L is:

VD = $\frac{√3}{2}\*R\*2\*L\*I$

Where R is the resistance of a given conductor per foot and I is the current passing through the cable.

From NEC Chapter 9, Table 8 (Conductor Properties), the resistance of coated 4/0 wire is 0.0000626Ω/ft.

Assuming the worst case condition, I = 175A (the rating of the fuses in the upstream fused disconnect).

VD = $\frac{√3}{2}\*\frac{0.0000626Ω}{ft}\*2\*393ft\*175A\*V/ΩA$

VD = 7.46V.

**Allowable Voltage Drop:**

NEC Article 210.19(A)(1) IN4 suggests that voltage drop on the feeder conductors should not exceed 2 to 3 percent. With the source voltage indicated to be 480V, the maximum voltage drop should be less than 14.4V.

**Conclusion:**

The expected three-phase voltage drop over the 393 feet of 4/0 cable at maximum current is less than 3 percent of the source voltage so the cable in the reel is properly sized.